

by a west or northwest wooded area. Little difference is observed whether the grape rows parallel the wooded or waste land strip, or are perpendicular to these conditions in the area affected by the moth, for the spread seems to be uniformly deep under each condition. By reference to the accompanying map (Fig. 10) a remarkable variation in percentages of infestation in portions of the various vineyards will be noted.

During the summer of 1919 spraying and dusting experiments were carried on in the vineyard which had a heavy infestation, and although results were excellent, they were not reliable, for it has been proven that the heavily infested area coincided with the check plot, the only manner in which the relative merits of spray materials can be determined against this pest is to be certain that the areas treated in both cases are uniformly infested, which is not the case throughout this region, except the one uncultivated field mentioned above.

In conclusion it seems only reasonable to believe that the most effective way to control the grape berry moth is by burning over and clearing waste places and head lands. This was tried out by one grower during the season of 1920, and showed excellent results where a spotted infestation had occurred the previous season. In cases where trees or vegetation are left as protective wind breaks, the general spraying must be continued, but it is shown that in many cases the study of the local conditions will help the grower to combat this pest more easily. Great emphasis should be placed, however, on cultural and clean farming methods in attempts to control the grape berry moth.

THE EFFECT OF TIME OF SOWING UPON THE CONTROL OF THE WHEAT SHEATH WORM (*HARMOLITA* *VAGINICOLUM* DOANE)¹

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Observations commenced in 1918 and continued through four seasons, have pointed to time of sowing as an effective control for this injurious wheat insect in Ohio. The annual Wheat Insect Survey has given us data pertaining to both *Harmolita tritici* and this species with respect to date of sowing. Observations upon the development of *H. tritici* have not shown much relation between sowing dates and degree of infestation. In 1918, when observations were commenced with *H. vaginicum*, it was apparent that time of sowing had a great deal to do with the degree of infestation. During that year in Northeastern Ohio all spring wheat and all late sowed winter wheat were badly infested with this insect, and the yields greatly reduced.

¹Formerly genus *Isosoma*. Revised by Phillips and Emery, Proc. U.S. Nat. Mus. 55, pp.440.

The injury was first described by Doane² in 1916, who observed serious damage to occur on the dry farms of Utah. The adult insect lays several eggs in the leaf-sheath around the stem above the upper joint. The larvae developing within cells in the sheath, cause a swelling and hardening, which later results in the sheath above this point becoming much enlarged. If the plant is well developed at egg-laying time, the affected straw is short, and usually greatly distorted or bent at the upper joint. If the plants are quite young at the time of oviposition, the head is always stunted, and is often undeveloped or unable to push its way beyond the topmost leaf-sheath. Many straws do not get tall enough to be cut by the reaper. This is especially true of wheat growing in finishing furrows where growth has been retarded, and the straws are more suitable for the work of the insect. An infestation of 20% may mean a loss of one-fifth of the yield. The same infestation of *H. tritici* will probably reduce the yield but little, unless lodging occurs. *H. tritici* infested straws usually mature a satisfactory head.

In Ohio the injury due to *Harmolita vaginicum* has been severe only in the northeastern counties. This includes ten counties east and northeast of Lorain, Wayne, and Harrison. During 1918 severe loss occurred in this section to all wheat sowed after October 1st. Spring wheat suffered the worst. The injury decreased gradually until 1921, when joint-worm, was at a low ebb all over the State. During this year specimens of *H. vaginicum* were taken along the Ohio River near the southern point of the State and at points in southeastern counties.

The surveyors did not observe any specimens in western Ohio. It is probably generally distributed over the eastern one-half of the State and most abundant in the northeastern section.

Date of sowing plats are maintained at most of the county experiment farms for the purpose of determining the best wheat sowing date through a series of years, and the effect of hessian fly upon wheat sowed at various times. Two of these county experiment farms, namely, Trumbull County and Mahoning County, have had the date of sowing plat going for five years. These counties are located in the section of the State where *H. vaginicum* is the dominating species. Each year of the Wheat Insect Survey, except one, the writer has inspected these plats to determine the presence of this species and the effect of time of sowing upon its prevalence. In 1919, the data were collected by Mr. J. S. Houser of the Ohio Experiment Station. Usually 200 straws were examined and the percentage of infestation determined for the plat. These are here given for the years 1918—1921.

²*Isosoma vaginicum*, Jour. of Econ. Ent., Vol. 9, No. 5, pp. 398.

PERCENTAGE OF STRAWS INFESTED BY HARMOLITA VAGINICOLUM

1918

| <i>Trumbull County</i> (Experiment Farm) | <i>Mahoning County</i> (Stooksberry Farm) |
|---|--|
| Sowed Sept 4..... | Sowed Sept 2nd week..... |
| " 15..... | Oct. 1st week..... |
| " 22..... | Nov 1st week..... |
| Oct 1..... | |
| " 10..... | |
| Spring Wheat..... | |
| Too young to detect. | |

1919

| | (Experiment Farm) |
|-------------------|-------------------|
| Sowed Sept 9..... | Sowed Sept 4..... |
| " 18..... | " 18..... |
| " 23..... | " 23..... |
| Oct 1..... | " 30..... |
| " 10..... | Oct 11..... |
| Spring Wheat..... | " 20..... |
| | |

1920

| | |
|------------------------------------|-------------------|
| Sowed Sept 3..... | Sowed Sept 2..... |
| " 9..... | " 12..... |
| " 16..... | " 19..... |
| " 20..... | " 30..... |
| " 23..... | Oct 10..... |
| Oct 2..... | " 22..... |
| " 14..... | |
| " 23..... | |
| Spring Wheat. Too young to detect. | |

1921

| | |
|--------------------|----------------------|
| Sowed Sept 29..... | Sowed Sept 1..... |
| Oct 7..... | " 10..... |
| " 15..... | " 20..... |
| " 26..... | Oct 4..... |
| Nov 5..... | " 9..... |
| Spring Wheat..... | " 20..... |
| | Spring Wheat..... |
| | Too young to detect. |

From the data in the tables, it is seen that a very good control is secured in northeastern Ohio by avoiding the sowing of wheat after October 1st. Late sowed wheat and spring wheat suffered the most, the latter being very severely damaged, altho this damage did not show up until after the winter wheat was harvested.

The control of this species does not necessarily conflict with the control of hessian fly, when we consider that the fly-free sowing dates for this section of Ohio commence about September 23rd. There is then a period of time between the first fly-free dates and the first date of serious infestation from *H. vaginicum*, during which time wheat may be sowed and avoid both insects. The length of this period apparently varies with the season, but it is usually sufficient to avoid a serious outbreak of either. In most years, sowing during this period of immunity will give protection from both of these insects.